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㊿発明の名称　タイヤコードすだれ織物用複合緯糸

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明　細　書

1. 発明の名称

タイヤコードすだれ織物用複合緯糸

2. 特許請求の範囲

６０％以上の破断伸度を有するポリアミド又はポリエステルマルチフィラメントとセルロース系マルチフィラメントを交絡させたタイヤコードすだれ織物用複合緯糸

3. 発明の詳細な説明

＜産業上の利用分野＞

本発明はタイヤ補強用すだれ織物用緯糸およびこの緯糸を用いたすだれ織物に関する。

＜従来技術＞

タイヤとくにラジアルタイヤにおいて伸長可能な緯糸を用いたタイヤコードすだれ織物はタイヤ成形工程のインフレーション時、緯糸が切断することなく伸長するため経糸の間隔が均一に保持され均一性にすぐれたタイヤの製造に効果がある。

このような伸長可能な高伸度緯糸としてポリエステル等の半延伸糸や部分配向糸（ＰＯＹ）に綿等の非熱溶融性短繊維を被覆した芯紡績糸が用いられている。このような緯糸は経糸と織目ずれ防止や、タイヤ成型中の緯糸の伸長には効果があるがタイヤコードすだれ織物の熱処理後、タイヤ成型工程で充分な破断伸度（７０～８０％以上）を安定的に得るのが難しく、かつこのような芯紡績糸を製造するには特殊な芯紡績装置が必要であり、製造コストも高い欠点がある。

また、このような欠点防止のためポリアミド又はポリエステルの未延伸糸、半延伸糸等に流体噴射加工を加えて糸表面上に多数ループ状毛羽を付与した緯糸が用いられている。

このような緯糸は経糸との目ずれ防止や、タイヤ成型中の緯糸の伸長には効果があるが、ポリアミドの未延伸糸等の噴射加工の場合は常温における初期ヤング率が小さくすだれ織物の管巻、製織工程においてループ状毛羽が伸びる傾向があり、またすだれ織物を巻取時（特に熱処理後）その巾変動が大きく巻姿を損う欠点がある。

ポリアミドおよびポリエステルの半延伸糸、半

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COMPOSITE WEFT FOR TIRE CORD FABRIC
[Taiya koodo sudare orimono you fukugou ishi]

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UNITED STATES PATENT AND TRADEMARK OFFICE
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FOREIGN TITLE

(54A): TAIYA KOODO SUDARE ORIMONO YOU FUKUGOU ISHI

Specification /1*

1. Title of the Invention

Composite Weft for Tire Cord Fabric

2. Claim

A composite weft for tire cord fabric obtained by interlacing a polyamide or polyester multifilament having a rupture elongation of no less than 60% with a cellulosic multifilament.

3. Detailed Description of the Invention

<Field of the Invention>

The invention relates to a weft for cord fabric utilized to strengthen tires and to a cord fabric obtained by using this weft.

<Related Art>

A tire cord fabric for a tire, a radial tire in particular, employs a stretchable weft, and it is effective for the manufacture of tires having excellent uniformity since it stretches without breaking and thus maintains the warp intervals constant at the time of inflation, which is part of the tire molding process.

As such a stretchable, high-elongation weft, a coil spun yarn obtained by coating a semi-drawn yarn or partially oriented yarn (POY) consisting of polyester or the like with a non-hot-melt short fiber consisting of cotton or the like is utilized. This type of weft, although effective for preventing the weave pattern from being dislocated against the warp and effective for the elongation that occurs during tire molding, does not stably provide a sufficient rupture elongation (70 - 80% or higher) during the tire molding process, and the manufacture of such a core spun yarn has shortcomings in that it requires a special core spinning device and in that the manufacture cost is high.

In order to overcome such shortcomings, a weft currently being utilized is obtained by subjecting an undrawn yarn or semi-drawn yarn consisting of polyamide or polyester to a fluid injection process and by then providing the surface of the yarn with many looped feathers.

This type of weft, although effective for preventing the weave pattern from being dislocated against the warp and effective for the elongation that occurs during tire molding, demonstrates a small initial Young's modulus at normal temperature when an undrawn yarn of polyamide or the like is subjected to an injection process, and tends to cause the looped feathers to elongate in the spool winding or weaving process. It also has the shortcoming in that the winding shape becomes spoiled due to fluctuations in its width when the cord fabric is taken up (particularly after a heat treatment).

A weft that was made from a semi-drawn yarn or the like consisting of polyamide or polyester and that has been subjected to a fluid injection process demonstrates a drastically small initial Young's modulus in the heat-treatment temperature range of between 200 and 240°C. Therefore, when the cord fabric is

heat-treated, particularly at a low tension, the cord fabric becomes susceptible to a ruffling phenomenon inside the furnace, and this causes wrinkles to occur in the cord fabric from the connecting parts or intermediate tabby parts (reinforced parts of the fabric in which a thick weft is weaved in at a high density) when the fabric is continuously processed.

<Problems that the Invention is to Solve>

With respect to a weft for tire cord fabric that has high elongation properties and that has many looped feathers stably equipped to its surface, the invention aims to provide a weft for tire cord fabric that is easy to handle at the time of spool winding or weaving, that prevents the cord fabric from wrinkling at the time of a heat treatment, and that improves the winding shape of the cord fabric, particularly after a heat treatment.

<Means for Solving the Problems>

The present invention relates to a composite weft for tire cord fabric obtained by interlacing a polyamide or polyester multifilament having a rupture elongation of no less than 60% with a cellulosic multifilament.

The polyamide multifilament having a rupture elongation of no less than 60% mentioned in the invention is an undrawn yarn, semi-drawn yarn, or POY consisting of

Nylon 66 or 6.

Moreover, the polyester multifilament having a rupture elongation of no less than 60% is an undrawn yarn, semi-drawn yarn, or POY consisting of polyester containing polyethylene terephthalate as the main structural unit.

Moreover, the cellulosic multifilament is a multifilament consisting of rayon or cupra.

A composite weft of the invention for tire cord fabric consists of a first filament and a second filament and is obtained by a fluid injection process in which the second filament is overfed with respect to the first filament.

Moreover, a composite weft of the invention for tire cord fabric can employ multiple yarns for each of the first and second filaments.

If the rupture elongation of the polyamide or polyester filament is less than 60%, rupture occurs at the time of tire molding and may disarray the tire cords.

The cellulosic multifilament employed in the composite weft of the invention for tire cord fabric improves the initial Young's modulus at normal temperature, increases the looped feathers, and also prevents the looped feathers from decreasing during the spool winding or weaving process. It also has the favorable effect of reducing the fluctuation ratio of the width of the tire cord fabric when

it is wound up in a cylindrical shape after being immersed in an adhesive solution (i.e. RFL solution), dried, and heat-treated.

Furthermore, the cellulosic multifilament employed in the composite weft of the invention for tire cord fabric drastically improves the initial Young's modulus at temperatures around 200 - 240°C, substantially reduces the ruffling of the tire cord fabric inside the furnace, and prevents the occurrence of wrinkles.

As for the ratio between the polyamide or polyester multifilament and the cellulosic multifilament, the above-described effects will be increased if the ratio of the cellulosic multifilament is increased, although there will be a dramatic decrease in strength when the cellulosic multifilament is cut up. Therefore, it is necessary to select an optimum value.

The initial Young's modulus will be increased by shortening the length of the cellulosic multifilament in a relative manner. This will increase the above-described effects and make the looped feathers firm. It should be noted that, in order to achieve even smoother elongation, the yarn length can be increased in a relative manner by overfeeding the cellulosic multifilament.

By increasing the amount of polyamide or polyester

multifilament in comparison to the cellulosic multifilament, or by semi-drawing the polyamide or polyester multifilament, it is possible to prevent the cutting part of the cellulosic multifilament from becoming elongated selectively, and a smooth load elongation curve can be obtained as a result.

<Embodiments of the Invention>

75 denier (d) - 45 filaments (f) of cupra and undrawn 108d - 13f of Nylon 66 were pulled together evenly and supplied as the first filaments, and undrawn 180d - 34f of Nylon 66 were used as the second filaments to be overfed. By setting the yarn speed of the first filaments to be 164m/min., the yarn speed of the second filaments to be 195m/min., and the take-up speed to be 140m/min., a fluid injection process was carried out.

The composite wefts obtained as a result were implanted in a tire cord fabric containing Nylon 66 as the warps (840d - 2×2, 55 filaments/5cm), immersed in an RFL solution, and dried. Then, they were each subjected to a heat treatment for 40 seconds at 232°C while applying a tensile force of 1.5kg in the set zone and 0.9kg in the normalize zone per cord.

As a result, as indicated by Embodiment 1 in Table 1,

the degree of ruffling of the tire cord fabric became very low in the heat-set and normalize zones, and no wrinkles were detected near the connecting part or intermediate tabby part. The width deformation ratio of the fabric detected after the heat treatment was 0.92%. The load elongation curve at normal temperature of a weft extracted from the heat-treated cord fabric is indicated in A of Figure 1, and the load elongation curve of the same at 200°C is indicated in A of Figure 2. The weft extracted from the heat-treated cord fabric had the initial Young's modulus of 6.25g/d at normal temperature and 4.25g/d at 200°C, the rupture elongation of 159% at normal temperature, and the strength of 245g.

Also, by using 75d - 26f of rayon as the first filaments and semi-drawn 126d - 34f of Nylon 66 that had been drawn by 1.5 times as the second filaments, the same injection process as that of Embodiment 1 was carried out. They were then implanted into a similar cord fabric and were subjected to the same heat treatment. As a result, excellent outcomes were obtained as indicated in Embodiment 2 of Table 1 and by B of each of Figure 1 (the elongation curve at normal temperature) and Figure 2 (the load elongation curve at 200°C).

Also, by using 75d - 45f of cupra as the first

filaments and 100d - 36f of polyester POY having the rupture elongation of 88% as the second filaments, the same injection process as that of Embodiment 1 was carried out. They were then implanted into a similar cord fabric and were subjected to the same heat treatment. As a result, excellent outcomes were obtained as indicated in Embodiment 3 of Table 1 and by C of each of Figure 1 and Figure 2.

For Comparative Example 1 indicated in Table 1, undrawn 108d - 13f of Nylon 66 were used as the first filaments and undrawn 180d - 34f of Nylon 66 were used as the second filaments. By setting the yarn speed of the first filaments to be 164m/min., the yarn speed of the second filaments to be 195m/min., and the take-up speed to be 145m/min., a fluid injection process was carried out. These wefts were implanted into a similar cord fabric to that of Embodiment 1, and the same heat treatment was carried out. As a result, a lot of ruffling occurred in the cord fabric in the furnace, and wrinkles occurred near the connecting part and intermediate tabby part. Moreover, the post-heat-treatment width deformation ratio was 4.58% and poor. The load elongation curves at normal temperature and 200°C of the wefts extracted from the heat-treated cord fabric are indicated by D in Figure 1 and Figure 2, respectively.

<Effects of the Invention>

A composite weft of the invention for tire cord fabric having the above-described structure has high elongation properties, a high initial Young's modulus at normal temperature, increases looped feathers, and prevents the looped feathers from decreasing during the spool winding or weaving process. Moreover, it reduces the ratio of the width deformation of the tire cord fabric which will occur when the fabric is wound up in a cylindrical manner after the heat treatment.

Moreover, since the initial Young's modulus is improved drastically around 200 - 240°C, the degree of ruffling of the tire cord fabric that occurs in the furnace is lowered dramatically, and wrinkles are kept from forming near the connecting part or intermediate tabby part.

Table 1

	WE 1	WE2	WE3	CE1	CE2	CE3
Degree of interlacing of looped feathers	◎	◎	◎	△	-	-
Ruffling of cord fabric in furnace	○	○	○	x	-	◎
Wrinkling of cord fabric during heat treatment	◎	◎	◎	x	-	◎
Fabric's width deformation ratio after heat treatment (%)	0.92	1.41	1.06	4.58	-	0.70
Initial Young's modulus at normal temperature after heat treatment (g/d)	6.25	10.2	12.6	3.24	17.0	25.6
Initial Young's modulus at 200°C after het treatment (g/d)	4.25	5.13	8.24	0.74	2.80	16.2
Rupture elongation at normal temperature after heat treatment (%)	159	132	83	134	76	6.2

[Translator's note: WE denotes Working Example and CE denotes Comparative Example in the table.]

Remarks: ◎ = excellent; ○ = favorable; △ = slightly poor;

x = poor.

The width deformation ratios of the fabrics were calculated based on the following formula and are expressed in percentage.

(the maximum width of the core) – (the surface width (minimum width))

/ (surface width)

(It should be noted that the measurements were carried out when the radiuses were 50cm excluding the wooden cores.)

The measurements of the initial Young's moduli at normal temperature were performed on 10cm of samples at the

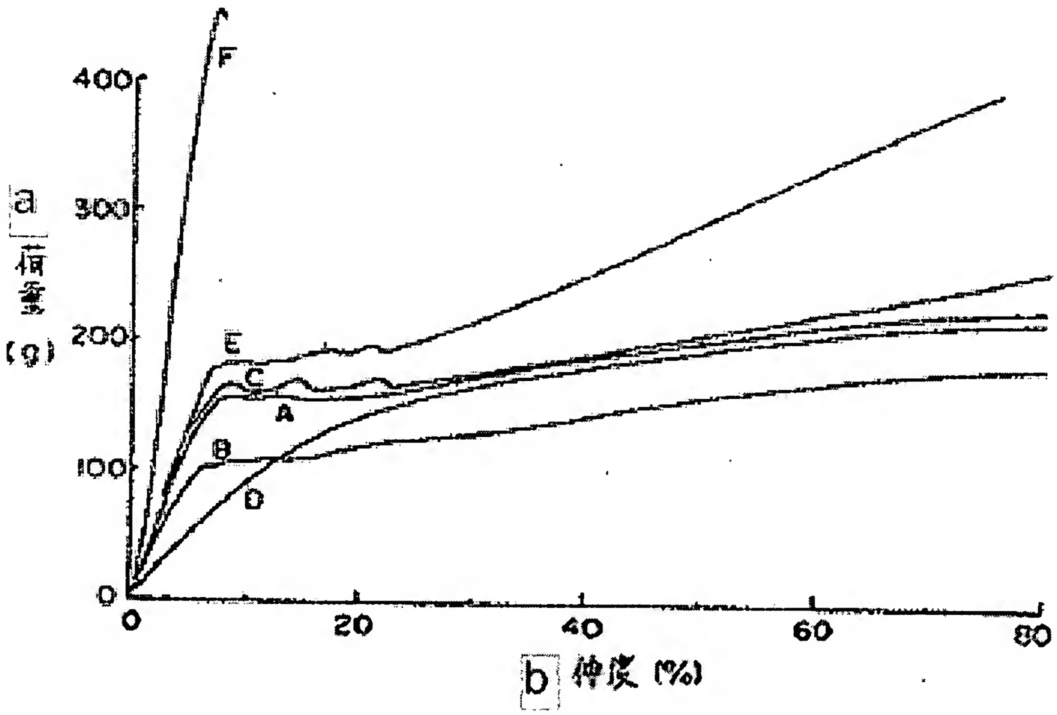
tension rate of 20cm/min. by using a Tensilon in the atmosphere of 20°C × 65% RH.

The measurements of the initial Young's moduli at 200°C were performed on 10cm of samples at the tension rate of 20cm/min. by using an Autograph in the atmosphere of 200°C.

4. Brief Description of the Drawings

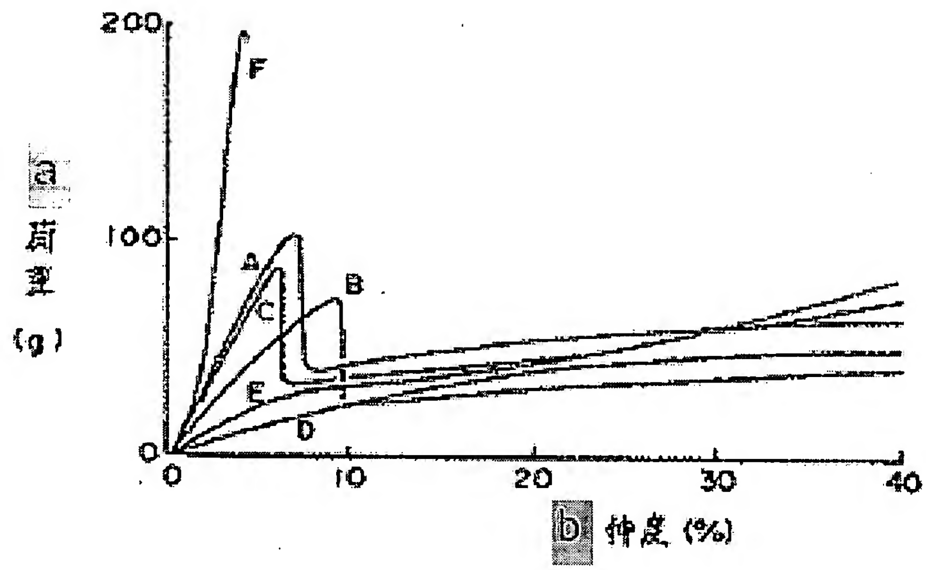
Figure 1 and Figure 2 indicate the load elongation curves of the wefts extracted from cord fabrics having been immersed in RFL, dried, and heat-treated. Figure 1 shows the results (indicated up to the rupture elongation of 80%) of the measurements performed at normal temperature, and Figure 2 shows the results (indicated up to the rupture elongation of 40%) of the measurements performed in 200°C atmospheres. In the figures, A, B, and C represent Embodiments 1, 2, and 3, and D, E, F represent Comparative Examples 1, 2, and 3.

Figure 1



Key: a) Load (g); b) Elongation (%).

Figure 2



Key: a) Load (g); b) Elongation (%).